

City of South Daytona

Community Development Dept.

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MEMORANDUM

To: Joseph W. Yarbrough, City Manager

From: John Dillard, Community Development Director

Date: November 3, 2017

Re: **EFFECTS OF HURRICANE IRMA ON THE WASTEWATER SYSTEM IN ALONG THE RIVERFRONT IN SOUTH DAYTONA**

INFORMATION

As discussed, please find the attached letter report of the effects of the recent flooding of the wastewater collection and transmission systems that serve the eastern portion of the City. Overall, the collection system is sound, but some minor improvements are recommended to enhance its performance and minimize the effects of future flooding. The pump stations are well maintained but are getting old. Budgeting for replacement of the older stations is another consideration addressed.

THE EFFECTS OF HURRICANE IRMA ON THE WASTEWATER SYSTEM ALONG THE HALIFAX RIVER IN SOUTH DAYTONA

INTRODUCTION:

Hurricane Irma caused devastating effects on the wastewater system that serves the area along the Halifax River in South Daytona. This area bounded by the Halifax River to the east and the Florida East Coast Railroad to the west, is comprised of about 640 acres of wastewater collection systems and has five pumping stations. These stations vary in size, but together are responsible for collecting and transmitting all the wastewater generated in this area to Daytona Beach for treatment and disposal. Irma created a storm surge of water from the river that flooded the majority of the area between Ridgewood Avenue and the river. The extensiveness of this storm driven flooding has not been experienced at this level, in this area, for almost sixty years.

The main impact on the collection system during the storm was the inflow, or direct flow of flood waters into the piped system that moves wastewater from homes and businesses, into one of the five pumping stations. This inflow was the result of two culprits. The first being water flowing through both manhole covers and the second being inflow through damaged cleanouts. Cleanouts are a necessary component of the collection system and are required by state law to be placed in certain locations through the collection system. Most residences have at least two, and sometimes more, and are all on private property. The majority are 4" pipe and are sealed with a polyvinyl chloride (PVC) cap. These caps are usually located in grassed areas and can be easily damaged or totally destroyed, but because of their location, the damage goes undetected. The loss of the power grid for several hours had an effect on the operation of the system, but due to the permanent emergency generator located at PS #1 and portable generators at other stations in the area, this was not a major concern.

The Pump Station #1 (PS #1), collection system is the largest single system on the east side of the City. This collection system became completely inundated and caused the station to overload to a point where it was ineffective. Homes with low finish floor elevations could easily experience water in the collection system backing up into homes. This was reported in about seven homes throughout the City, five were in the PS #1 collection area.

The five pumping stations in this area of the City are well maintained, but with an average age of 25 years old, consideration of replacement or renewal should be given. The pumps in PS #1 were planned to be replaced prior to the storm and were shipped and installed within two weeks after Irma. These pumps have 25% more capacity and pumping pressures when compared with the pumps in the station during Irma. The increase in pumping pressure of these new pumps will reduce the effects of high water conditions in the receiving pump station of Daytona Beach. This was another factor that reduced the existing pumps capability during the storm.

Of the other pump stations in the study area, PS #8 and #9 were the most affected. PS #8 is one of the newer stations in this system, but due to the corrosive nature of the waste it receives, it is in the worst condition and its replacement was planned for this year. An upgraded pump station with stainless steel piping and base plate has been ordered and will be in place before the end of this

year. The only other station with problems was PS #9. This is located in a low area on Sandusky Circle and flood waters reached an elevation that shorted out a stepdown transformer inside the station causing the pumps to fail. This transformer was replaced immediately after the storm and was elevated to protect it from future flooding.

RECOMMENDATIONS:

The wastewater collection areas along the river and South Palmetto Avenue are low and will always be subject to flooding during major events such as Hurricane Irma. However, there are a few things the City can do to better protect homes and businesses in this low lying area. The following priority improvements will insure the protection of homes in this area.

1. Inspect and repair or replace as needed, all rain catcher devices in manholes to insure they are all protected and in good operating condition. The collection system for PS #1 was the main system effected and it was found that five rain catchers were either not working properly or were missing. Since the storm, the system has been inspected and all of the manholes are equipped with these devices and are working properly. These devices cost less than \$100 each and provide great protection from inflow through manhole covers. Public Works should keep at least two standard 24" inserts and two 30" inserts in stock. This would be about \$400 and would insure quick replacement in the field if needed.
2. Install backflow devices in the sewer service line for all homes that experienced backups from the collection system during Irma. These devices cost about \$450 each and the installation is about \$350. Public Works has ordered 15 of these devices and will have them installed on the known affected homes by the end of November 2017. Public Works will have in stock several more as other homes with the potential problem are found.
3. A priority replacement schedule needs to be developed for the upgrade/replacement of these pumping stations in this portion of the City. As shown in the body of the report, age is not the overriding factor for determining replacement. However, with the replacement of the pumps in PS #1 and the total replacement of PS #8 later this year, this is a good start towards renewing the system. PS #3 should be budgeted for replacement in the 2018/19 fiscal year. The cost to totally replace the pump station and clean the existing wet well is about \$75,000. PS #16 should be budgeted for replacement in the 2019/20 fiscal year. The cost to totally replace the pump station and clean the existing wet well is also about \$75,000.

OPERATION ASPECTS OF COLLECTION/TRANSMISSION SYSTEM

The area of South Daytona most affected during the recent storm named Hurricane Irma, was along the Halifax River and South Palmetto Avenue. The most affected City utility was the wastewater collection and transmission system. This portion of the City is not only one of the lowest areas elevation wise within the City, but also due to the close proximity to the Halifax River, it has the most corrosive saltwater environment for equipment exposed to the elements.

Hurricane Irma created one of the most destructive tidal surges in this area since Hurricane King did back in 1950. The storm surge from Irma reached elevations between 6.0' to 6.5' mean sea level NADA 1988, depending where measurements were taken after the storm. This equated to over 3' of standing water along most of South Palmetto Avenue. On October 19, 1950, Hurricane King hit this area with a similar size, following a similar path and creating an identical easterly wind that drove the Atlantic Ocean to a surge level slightly above the measured surge with Hurricane Irma. However, with Hurricane King, most of the river frontage was undeveloped and the damage was minimized.

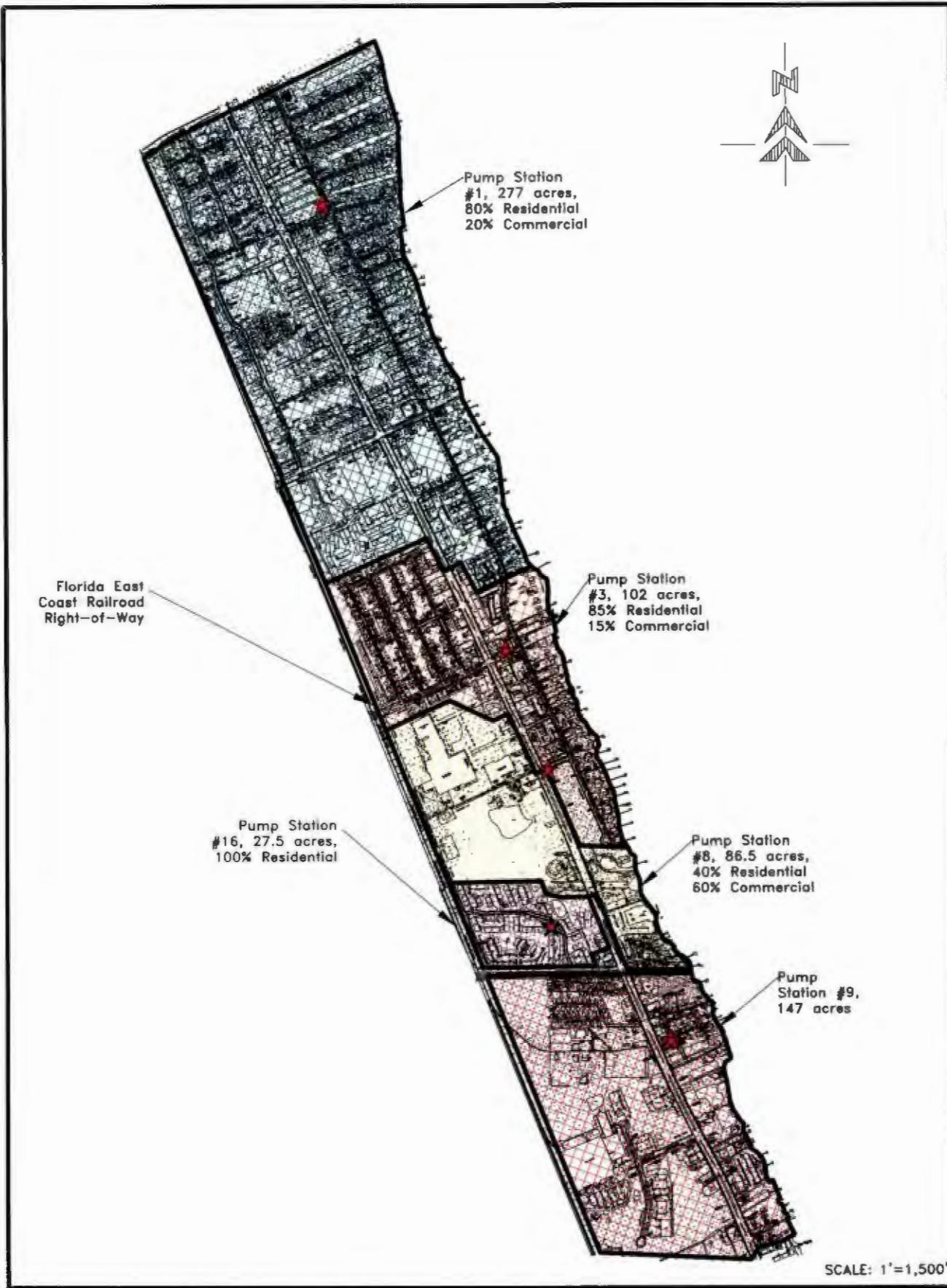
As you can imagine, this standing water created devastating problems for the wastewater collection and transmission systems in the vicinity of the Halifax River. The City's wastewater system that serves this area, also serves all of the City east of the Florida East Coast Railroad right-of-way. (See figure I) This is an area of approximately 640 acres and generates on the average 600,000 gallons per day (gpd) of wastewater. Pump Station #1, located at the corner of South Palmetto Avenue and Bellewood Avenue, is the master pump station for the eastern portion of the City. This pump station ultimately pumps all of the eastern portion of South Daytona's flow to Daytona Beach for treatment and disposal.

PUMP STATION DESIGN CRITERIA

There are many factors that can determine the design parameters of a wastewater pumping station. However, the main factor is the amount of wastewater the pump station will be required to pump in a 24-hour period. Most design recommendations in the industry are based on the average daily flow converted to a flow in gallons per minute (gpm), with a peaking factor of 300%. This is expressed in the following:

1. Average Daily Flow = 600,000 gpd
2. Average flow/1,440 minutes per day = $600,000/1,440 = 417$ gpm
3. Pump Rate 300% (Peaking Factor) = 417 gpm x 300% = 1,250 gpm required

This peaking factor is actually a safety factor that helps the pumping station handle seasonal flows and other conditions that may elevate the daily flow well above normal. There are other requirements for pumping stations and they are outlined in the Florida State Statutes and are dependent on the pump station's daily pumping capacity. Small pumping stations may need only the basic features. As pump stations increase in size and are more relied upon, equipment redundancy and the ability to operate during extreme conditions and during power outages becomes essential. All of the City pumping stations contain equipment redundancies with the use of a duplex (2) pumps and controls. The smaller pumping stations in the City have emergency



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power connections that allow for portable generators to be used during power outages. The larger stations are equipped with stationary emergency power generators to insure operation in all conditions. This is a rather simplified discussion and there are many other features and factors required by the Florida Department of Environmental Protection (FDEP). The City's stations meet or exceed all of these requirements.

When the full force of Irma hit the City, a series of events played out that caused many problems for the pump stations and collection systems in that area of the City. Each pump station was affected differently. However, all of the collection systems within this area were affected the same way; total inundation with the tidal surge. The following portion of this report addresses the storm created problems for each pump station in this section of the City and the corrective actions taken before the data was collected for this report.

PUMP STATION No. 1

Existing Condition:

This pump station is one of the oldest in the City and the original structure dates back to the 1950s. In 1989, the City had the pump station renovated with new pumps, controls, all electrical systems and a new diesel emergency generator with an automatic transfer switch to automatically start the generator when conventional electrical power is lost. This was "state of the art" in 1989, and has served the City well for almost 30 years. But as you know, time and the corrosive environment slowly chip away at the pump efficiencies and the reliability of the electrical systems.

During the height of Hurricane Irma, the power failed and the emergency generator started and ran as designed. The river tidal surge covered South Palmetto Avenue with 3'+ of river water and totally inundated the collection system in the area of PS #1. Most wastewater collection systems are subject to inflow from manhole covers and broken cleanout caps and this system was no exception. The existing pumps in the station were operating well, but were tasked with an impossible job. According to the manufacture's information the pumps were capable of pumping 800 gallons per minute and the duplex system could pump approximately 1,600 gallons per minute (gpm). With an average daily flow of 700,000 gpd, Pump Station #1 would be capable of pumping more than the recommended flow rate described earlier. However, once a collection system is submerged and inflow into the system begins, the pumps will never handle the flow. To exacerbate the situation, PS #3 and #8, both pump directly into the collection system of pump station #1, adding an additional 1,000 gpm flow into an already flooded system.

Corrective Measures:

Last spring, Public Works ordered replacements for the two main pumps at this station. These pumps have an increase of about 25% in capacity over the old pumps and will operate better during high water level conditions in the receiving system in Daytona Beach with a 25% increase in maximum pumping pressures. These new pumps were ironically delivered the week after Hurricane Irma, and are now installed and are in full operation.

Other improvements in the station include the replacement of all electrical wiring from the emergency generator to the pump station. The underground conduit for this wiring filled with

brackish water from the river, when the area around the station was flooded and caused damage to the insulation on the wire in the conduit. This caused problems with the main breaker tripping, but did not become an issue until several days after the storm. This replacement will insure proper operation of the emergency power supply in the future.

In the collection system, two actions have been initiated to help reduce future flooding impacts to the system. The City utilizes a device called a Manhole Infiltration Protector. This is a concave shaped insert made of a thermoplastic that is placed in the manhole cover ring and the manhole cover rests on top of this device. This product is inexpensive and greatly reduces inflow into the manhole during times of street flooding. Most of the system along South Palmetto already had these inserts in place, but five locations were found where they were either missing or damaged. These have been replaced and the others have all been inspected to insure they are functioning properly.

The second action that has been initiated is the identification of homes where the finish floor elevation is extremely low and the possibility of wastewater backup into the homes could occur. Six locations have been identified as concerns; 1833 S. Palmetto Ave., 2131 S. Palmetto Ave., 2200 S. Palmetto Ave., Apt 6, 2201 S. Palmetto Ave., and 117 Nautical Dr.. In cases such as these, an in-line backflow device can be installed in the service lateral between the house and the gravity main in the street. This will allow flow from the home to the collection system during normal conditions, but would not allow the flow to backup into the home during flooding. However, the homeowner would not be able to use any plumbing fixtures during the flooding event, as the water could not enter the collection system when the device is engaged. The City has ordered 15 of these devices for the above addresses and any future connections that would be susceptible to wastewater backflow. The proposed units should be installed at the above addresses by the end of November 2017.

As mentioned earlier, inflow into the wastewater collection system is a major problem and the main factor in wastewater systems failing during floods. South Daytona was not alone in feeling its effects. FDEP discharge reports showed more than 28 million gallons of treated and untreated sewage was released in 22 counties in Florida during Hurricane Irma, and stated that the total amount is surely much higher. Due to failures in the City of Ormond Beach, they were one of the top 10 violators in Central Florida during this storm. Also many local communities experienced wastewater backing up into homes and businesses, all because of flooding.

Other than the inflow of flood waters into manholes, the other main culprit that allows unwanted water into a wastewater system is sewer cleanout caps. Cleanout fittings are required to be placed within 5 feet of the home wherever a wastewater line leaves the house and goes towards the City collection system. The other required location for these cleanouts is on the property line where the sewer service connects to the City system. These are usually 4" threaded PVC caps with a square wrench lug on top. These caps are notorious for being damaged by lawn mowers and in most cases the damage goes undetected. These caps are typically on private property and should be located by the property owners to assess their condition and replace if damaged. This one action would immensely reduce the inflow of flood waters into the wastewater collection system and the likelihood of system failure during flooding events.

PUMP STATION No. 3

Existing Condition:

This pump station is an above ground duplex station manufactured by Smith & Loveless. Inc. The majority of the pump stations in the City are this type and brand of station. These are good systems with all the features as required by FDEP and are easy to service. This particular station was installed in May, 1984. It appears to be in decent operational condition for its age and has been well maintained. The pump station was partially submerged during the storm, but continued to operate until the power grid failed. This station is smaller than Pump Station No. 1, and serves mainly residential development. The estimated daily wastewater flow to this station is about 170,000 gpd. Using this flow factor of 300%, the needed flow capacity is about 350 gpm and the existing pump capacity 400 gpm per pump. This station has sufficient additional capacity for future development.

Corrective Measures:

This station continued to operate until the main power failed. The station did experience some flooding but continued to operate properly, once power was restored. Emergency power was provided directly after the storm passed and was maintained until normal power was activated. However, due to its 33 years of service, this station should be scheduled to be replaced. The pump station's good condition due to attentive maintenance and it's not critical to replace the station immediately, but I would recommend its replacement within the next three years.

About one-half of the wastewater collection system that flows to PS #3 serves South Palmetto Avenue. This system was also inundated during the storm and experienced the same problems discussed in the PS #1 collection system. However, the City did not receive any reports of wastewater backing up into residents tied to this system.

PUMP STATION No. 8

Existing Condition:

This pump station is also an above ground duplex station manufactured by Smith & Loveless. Inc. This particular station was installed in November 1989. It appears to be operating properly, but with some major concerns with its reliability and condition. This station is larger than PS #3, and receives flow from other pump stations (PS #9 & #16) that in the past has had very little flow. This means that wastewater would sit in the pump stations for extended lengths of time. This situation can create a condition where the raw sewage starts to break down and create hydrogen sulfide. This gas not only is known for its obnoxious odor, in damp environments it can mix with water to make hydro-sulfuric acid. This is the case at P.S. #8 and the piping in the wet well has become severely corroded. The corrosion is bad enough to cause small pin holes in the suction pipes to the pumps and can cause pump failure. Public Works attempted to replace the suction lines recently, but the bolts holding the pipe to the pumps were so corroded, they were afraid of irreparable damage to the pumps and stopped work. The pump station was not flooded during the storm, and continued to operate until the power failed. This station pumps directly to the PS #1 collection system, and is then re-pumped by PS #1 to Daytona Beach.

This station receives wastewater flow in about equal portions of commercial and residential and the total buildout estimated gravity wastewater flow to this station is about 190,000 gpd or about 132 gpm. The wastewater pumped to PS #8, is estimated to be about 310 gpm. Using these flows, the needed flow capacity is about 434 gpm and the existing pump capacity of PS #8, is 600 gpm per pump. These are estimated flows, but it appears that the station has the capacity to handle future flows from normal development in this area. The peak estimated flow using the 300% factor would be about 1,302 gpm, or slightly more than the 1,200 gpm of the station's current capability, but these are estimated flows and well within the margin of error. At this time, this station seems to have the capacity for future development.

Corrective Measures:

This station continued to operate until the main power failed. The station did not experience flooding and continued operation once power was restored. Emergency power was provided directly after the storm passed and was maintained until normal power was restored. However, due to its 28 years of service, and corrosive environment in the wet well, this station should be replaced. Fortunately, this pump station was budgeted to be replaced this fiscal year and the new station should be in operation before the end of this December. The new station is the same style and manufacturer as the existing station with one critical improvement; the piping and the metal baseplate exposed to the corrosive environment of the wet well will be manufactured out of stainless steel. This will help extend the life and reliability of the new station.

A small portion of the wastewater collection system that gravity flows to pump station #3, is south of South Palmetto Circle and north of Reed Canal. This area is typically higher in elevation than other riverfront property and was subject to less inundation from the rising river. However, the collection system in the Sandy Circle area did experience some flooding and same problems discussed in the PS #1 collection system. The City did not receive any reports of wastewater backing up into residents tied to this system.

PUMP STATION No. 9

Existing Condition:

This pump station is another above ground duplex station manufactured by Smith & Loveless, Inc. This particular station was installed in June, 2012. It appears to be in great operational condition and has been well maintained. The pump station was partially submerged during the storm, and experienced a failed stepdown transformer in the pump station during the tidal surge. This transformer operates the small vacuum pumps that keep the wastewater pumps primed and allows them to operate on demand. With the transformer shorted out from the high water, the pump station was inoperable. Once the storm passed, Giles Electric repaired the transformer and raised it to a point above the watermark left by the tidal surge to insure flood waters would not reach it in the future. This station is smaller than PS #8 and is a split between commercial and residential flows. The estimated future wastewater flow to this station is about 367,500 gpd. Using this flow factor, the needed flow capacity is about 255 gpm and the existing pump capacity 415 gpm per pump. This station has a lot of additional capacity for future development.

Corrective Measures:

This station ceased operation once the flood waters shorted-out the step-down transformer in the station. The station did experience some flooding but continued to operate once the transformer was replaced. This station is only about five years old and should have many years of service left. The pump station is in great condition and should not need to be replaced for at least another 20 years.

About one-third of the wastewater collection system that flows to PS #9 is along the Halifax River. This area included the high-rise condominium Halifax Landing. The newer, developed areas are typically higher in elevation than other riverfront property and was subject to less inundation from the rising river. However, the collection system in the Sandusky Circle area did experience some flooding and same problems discussed in the PS #1 collection system. The City did not receive any reports of wastewater backing up into residents tied to this system.

PUMP STATION No. 16

Existing Condition:

This pump station is another above ground duplex station manufactured by Smith & Loveless, Inc. This station is located in the development of Banana Cay. It was initially constructed as a private pump station, but was converted to a public station to serve some commercial properties along Ridgewood Avenue. This particular station was installed in August 1984. It appears to be in good operational condition and has been well maintained. The pump station was not affected by flood waters during the storm, and only ceased operating when the power grid failed. Once the power was restored, the station continued normal operation. This station is one of the City's smallest stations and receives 100% residential flows. The estimated future wastewater flow to this station is about 68,000 gpd. Using this flow factor of 300%, the needed flow capacity is about 141 gpm and the existing pump capacity 200 gpm per pump. This station has some additional capacity for future development.

Corrective Measures:

This pump station is a great example of old, well maintained equipment. This station did stop operation when power grid failed, but resumed full operation once the power was restored. However, due to its 33 years of service, this station should be scheduled to be replaced. The pump station is in good operational condition and it's not critical to replace the station immediately, but would recommend its replacement within the next five years.

All of the flow from this station is pumped to a manhole on the south side of the Sunshine Mall and gravity flows from there to PS #8. The collection system for this pump station area did not experience any flooding or wastewater back-ups into homes.